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Liability Structure in Small-scale Finance

Evidence from a Natural Experiment

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Abstract

Microfinance, the provision of small individual and business loans, has witnessed dramatic growth, reaching over 150 million borrowers worldwide. Much of its success has been attributed to overcoming the challenges of information asymmetries in uncollateralized lending. Yet, very little is known about the optimal contract structure of such loans—there is substantial variation across lenders, even within a particular setting. This paper exploits a plausibly exogenous change in the liability structure offered by a microfinance program in India, which shifted from individual to group liability lending. The analysis finds compelling evidence that contract structure matters: for the same borrower, required monthly loan installments are 6 percent less likely to be missed under the group liability setting, relative to individual liability. In addition, compulsory savings deposits are 19 percent less likely to be missed under group liability contracts.

This paper—a product of the Finance and Private Sector Development Team, Development Research Group—is part of a larger effort in the department to conduct policy-oriented research. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The author may be contacted at bzia@worldbank.org.

Liability Structure in Small-scale Finance: Evidence from a Natural Experiment*

Fenella Carpena, Shawn Cole, Jeremy Shapiro, and Bilal Zia†

1 Introduction

Theory and evidence highlight financial market imperfections as a central cause of poverty and a key impedement to growth (Banerjee and Newman, 1993; Galor and Zeira, 1993; Rajan and Zingales, 1998). In theories of capital accumulation for example, financial market imperfections influence the poor's ability to borrow for investments in education and physical capital. Additionally, in models explaining entrepreneurship, information asymmetries and transaction costs prevent profitable entreprenurial activities of the poor, who often have no collateral. Lack of access to financial services may thus play a crucial role in leaving many productive opportunities for the poor untapped, as well as in generating persistent income inequality and lower growth (Beck et al., 2008).[1]

Microfinance, the provision of credit, savings and other financial services to low-income households and entrepreneurs, has exploded in popularity and coverage in recent years, particularly in meeting the large unmet demand for finance (Morduch, 1999; Armendáriz de Aghion and Morduch, 2010). Emerging markets and developed economies alike, including the United States, now provide microfinance services through a variety of public and private channels. The growth of microfinance has been unprecedented: between 2004 and 2008, the sector's average annual asset growth rate was 39%, reaching US$60 billion in total assets by the end of 2008 (Chen et al., 2010). A careful evaluation of microfinance in Banerjee et al. (2009) has also revealed that microcredit does have important effects on business outcomes and the composition of household expenditure. The rapid

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[1]See World Bank (2008) for a literature summary.

growth of microfinance, along with its potential for promoting development, has attracted the interest not only of governments, donors, and socially oriented investors, but of mainstream commercial banks as well.

Perhaps the most celebrated feature of microfinance is the group liability contract, a lending methodology pioneered by the Grameen Bank in Bangladesh. Under this contract, loans without collateral are extended to a group of borrowers whose members are jointly liable for each other's repayment. Since groups form voluntarily and group members are responsible for paying off each other's debts, borrowers have the incentive to screen risky clients, monitor their peers, and enforce repayment. The success of this model with the Grameen Bank led to its replication in many other countries around the world, with over 150 million individuals reached at the end of 2007 (Daley-Harris, 2009). This model is particularly important given that small firms suffer most from institutional weakness (Beck et al., 2005), and because the structure of the banking sector can have important distributional impacts on growth (Cetorelli and Gambera, 2001).

While most microfinance organizations use group liability, not all do so. On the one hand, group liability may solve information asymmetry problems by leveraging social ties and the borrower's knowledge about the community, and reduce monitoring costs to the lender by motivating borrowers to monitor each other. On the other hand, social sanctions may be limited, bad clients may free-ride on good clients, and borrower groups may collude against the lender. In addition to group liability lending, many microfinance programs also employ a variety of approaches to maintain high repayment rates. For example, some programs implement frequent repayment schedules, progressive lending, or require collateral substitutes. And yet, very little is known about the efficiency of such designs in ensuring repayment.

Indeed, the question of an optimal loan contract structure remains largely unanswered in both the theoretical and empirical microfinance literature. Theoretical studies have mainly focused on explaining how and why group liability mechanisms work, offering competing predictions on its benefits, while the empirical literature lags behind the theory. An important exception is Giné and Karlan (2009), which reports on a field experiments in the Philippines to test the effect of individual versus group liability lending. Their analysis focuses on the importance of peer monitoring, and finds no significant difference in default among individual and group borrowers. However, they study existing group borrowers who convert to individual liability, and it is quite possible that the

social ties and repayment discipline instilled by group monitoring remain intact even with a shift to individual liability. Further, since they focus on pre-formed groups, they are not able to measure or identify the presence or importance of screening in group liability contracts.

Identifying the impact of group liability on outcomes such as default rate is complicated by the standard problems of selection and omitted variables bias. Individuals with different financial habits might choose to take one form of contract but not the other. Alternatively, lenders with different levels of sophistication may attract different client mixes, and offer different contracts. One cannot simply compare clients across lending contracts, since self-selection or other aspects of the program may be the root cause of any observed differences.

In this paper, we use a natural experiment to compare loan repayment and savings discipline between group liability and individual liability contracts.[2] Our empirical strategy takes advantage of a change in lending policies of Saath, a non-government organization providing microfinance services in India. Saath switched from individual liability to group liability lending. This transition was governed by a strict policy rule: after a particular date, all borrowers completing an individual liability cycle were subsequently switched to group liability in their next loan. Individual liability loan completion dates were distributed relatively uniformly throughout the year, which offers a natural variation in switching of loan contracts. Thus, in July for example, individual liability borrowers finishing a loan cycle would switch to group liability in the following loan, while those whose loan cycle ended after July would remain under an individual contract setting until the end of the cycle. This plausibly exogenous change was phased in over time, generating natural control groups, and allows us to credibly identify the causal impact of group liability structure. Further, since we have time series data both before and after group liability is introduced, we can study the dynamics of group borrower formation.

Consistent with Ghatak (1999 and 2000), we find evidence of assortative matching. Specifically, we find that the formation of groups is endogenous to borrower risk types: safe borrowers are significantly more likely to form joint liability groups with other safe borrowers, even controlling for other factors such as physical proximity.

Our main analysis focuses on loan performance and estimates the joint effect of assortative peer matching and ex-post peer monitoring under group liability. We find that group liability structure

[2]Throughout this paper, we use the terms "group liability" and "joint liability" interchangeably.

significantly improves repayment rates. In particular, clients are about 6% less likely to miss a monthly repayment in the group liability setting relative to individual liability; this effect holds even with individual fixed effects. We also find that there is greater discipline in monthly compulsory savings deposits when clients have a group liability loan. Specifically, compulsory deposits are about 19% less likely to be missed in the group liability setting. Our results provide the first credible evidence that group liability contracts improve upon individual liability, particularly in ensuring repayment and increasing savings discipline among clients.

From a practical and policy perspective, our results are quite timely. Microlenders worldwide are increasingly weakening joint liability in their lending approaches (Armendáriz de Aghion and Morduch, 2010). For example BancoSol in Bolivia has shifted significant proportions of its lending portfolio from group to individual lending, and even the Grameen Bank has moderated its joint liability clause, allowing defaulters to get back on track without invoking group pressure. Our results suggest a careful rethinking of such policy direction.

The rest of this paper is organized as follows. Section 2 reviews the existing literature on liability structure in microfinance. Section 3 provides a background on the microfinance program we study, as well as the change in liability structure of its loan products. In Section 4, we provide a description of the data and summary statistics, and discuss our empirical strategy and results in Section 5. Finally, Section 6 concludes.

2 Predictions of Group Liability

A wealth of theoretical literature in microfinance explores the mechanisms behind group liability contracts, particularly on mitigating information asymmetries and enforcement problems. Stiglitz (1990) shows that the group liability structure overcomes ex ante moral hazard, since it creates incentives for group members to monitor each other's loans. Although group liability induces borrowers to bear more risk, Stiglitz argues that the gains from monitoring exceeds this cost, leading to improved borrower welfare. Similarly, Banerjee et al. (1994) study credit cooperatives and underscore the role of peer monitoring. They describe a model where higher monitoring results in higher borrower effort, and hence, a higher probability of project success.

Even if a project succeeds, however, borrowers may refuse to repay or may claim that the

project failed to avoid repayment. This strategic default, or ex post moral hazard, is also captured in several theoretical studies on group liability. For example, Besley and Coate (1995) provide a model demonstrating that joint liability may harness social capital to increase a borrower's willingness to repay. Moreover, they show that if social penalties are sufficiently severe, group liability results in higher repayment rates than individual lending. Armendáriz de Aghion (1999) likewise demonstrates that joint liability agreements may increase the lender's ability to elicit debt repayments. It may also reduce the incidence of strategic default since borrowers may impose social sanctions on the defaulter.

In addition to examining moral hazard, the theoretical literature investigates how joint liability mitigates adverse selection. Ghatak (2000) describes a model under a scenario where borrowers have ex-ante information about the riskiness of other borrower's investment projects, while lenders do not. Joint liability then acts as a screening device inducing 'assortative matching.' Borrowers with safe investments will partner with other safe borrowers, leaving risky borrowers to form groups with themselves. In the case where borrowers do not have full information about each other's risk types, Armendáriz de Aghion and Gollier (2000) demonstrate that peer group formation may still mitigate adverse selection. They describe a 'collateral effect' where cross-subsidization among borrowers acts as a collateral behind the loan, thus enhancing efficiency.

These theoretical models, among others, have shown that group liability may improve repayment rates through alleviating imperfections in the credit market. However, whether group liability outperforms other contract structures remains an open question in the microfinance literature. For example, Besley and Coate (1995) point out in their model that group liability also creates a negative incentive effect. If borrowers cannot repay as a group, then some group members will not find it worthwhile to contribute their share of repayment, even though they would have repaid under individual lending. Rai and Sjöstrom (2004), on the other hand, argue that a system of cross-reports which elicits information about borrower's projects does better than both group and individual liability. With limited side contracting, such a system improves performance since it reduces the deadweight loss of harsh punishments.

Inconclusive empirical evidence accompanies these ambiguous theoretical predictions. Some empirical studies support the theoretical advantages of group liability. For instance, Wenner (1995) considers a group credit program in Costa Rica, and finds that groups which screened members and

used local information had lower rates of delinquency; in Bangladesh, Sharma and Zeller (1997) show that groups that were formed through self-selection had better repayment rates. However, both of these studies may suffer from omitted variable biases or selection problems. Other studies provide little empirical evidence for the theory: Wydick (1999) finds that in group lending in Guatemala, social ties have limited impact on repayment and that borrowers are in fact more tolerant with their friends; Ahlin and Townsend (2007) use Thai data to show that repayment rates are negatively associated with social ties.

Only a handful of studies examine the merits of group liability relative to other contract structures. Fischer (2009) conducts a series of lab experiments with actual microfinance clients and provides evidence that contract structure affects project selection. Specifically, he finds that group liability increases risk-taking, relative to individual liability contracts, as borrowers free-ride on the insurance provided by their partners. When project approval is required, however, risk taking under group liability is lower than both individual liability and an equity-like contract in which income is shared equally.

The most relevant study on repayment rates under different loan liability structures is Giné and Karlan (2009), who report evidence from a series of field experiments in the Philippines. In the first, borrowers who had signed up under a group liability structure were converted to individual liability, thus the authors can independently identify the peer monitoring effect under group liability since both joint and individual liability groups previously underwent the same screening. However, they cannot identify or rule out any impacts of screening with this methodology. In addition, the group repayment and monitoring mechanisms may already be entrenched and difficult to undo even with an indivdual liability structure. Their second experiment randomly introduced either group or individual liability lending to new borrowers. However, the experiment was at the loan center level and take-up was quite uneven between group and individual loan centers, resulting in potential statistical power concerns. In both instances, they find default rates are invariant to contract structure.

Our paper complements Giné and Karlan (2009) by examing optimal contract structure in an alternative setting. While the original experiment in Giné and Karlan (2009) focuses on moving from group to individual liability contracts, we explore the reverse; that is, the shift from individual to group liability. As such, we are able to study the dynamics of group formation and find evidence

on assortative matching.

The following section describes the setting and our empirical strategy in more detail.

3 Empirical Setting

Our partner institution, Saath, is a non-government organization based in Ahmedabad, India. Founded in 1989, Saath implements development initiatives in slum communities, including health, education, infrastructure improvement, job placement, and livelihood training programs. Additionally, Saath provides credit and savings services to the urban poor through its Microfinance Unit. In 2009, Saath Microfinance had over 6,400 active clients in 4 branches, with a savings portfolio of INR 18 million (USD 390,000) and a loan portfolio of INR 19 million (USD 410,000).[3]

While Saath has provided mentoring support to community-based credit and savings groups since the mid-1990s, its Microfinance Unit was not formally established until 2002. In that year, Saath integrated the credit and savings groups it previously mentored into its organization, as well as registered them as cooperative societies with the Indian government. Saath also began managing these credit and savings cooperatives at this time, giving way to the Saath Microfinance Unit. Today, Saath Microfinance provides various financial services to slum communities, including voluntary savings accounts, compulsory savings accounts, and group liability loans.

3.1 Savings Products

Since its inception in 2002, Saath Microfinance has been offering voluntary savings accounts to its clients. These voluntary savings earn an interest of 6% per year and do not have a minimum balance. As the name suggests, members are not obliged to make regular deposits in voluntary savings accounts. Any amount may be deposited, but only six withdrawals per year may be made.

In November 2007, Saath Microfinance initiated compulsory savings accounts among its members. Specifically, members are required to deposit INR 100 (USD 2) every month into compulsory savings accounts, for the duration of their membership with Saath Microfinance. Clients may withdraw any amount from their compulsory savings at any time, as long as a minimum balance of INR 3,500 (USD 70) is maintained. Similar to voluntary savings, compulsory savings earn an interest

[3]Based on Saath's 2008-2009 Annual Report.

of 6% per year. Any amount which the client deposits over the compulsory savings of INR 100 is deposited in the client's voluntary savings account. The goal of the compulsory savings account is to allow clients to build a financial buffer stock against adverse shocks. It also provides low-cost capital to Saath Microfinance. It is important to note that the compulsory deposits were mandated of all borrowers, independent of the switch to group liability loans. Hence, all outstanding loans under both individual and group liability were required to make compulsory deposits after November 2007. In the analysis section, we will compare the adherence to these compulsory deposits for the same person as s/he moves from individual to group liability.

3.2 Loan Products

In addition to savings products, Saath Microfinance provides loans for asset creation (e.g. house repairs), production (e.g. business working capital), and consumption (e.g. health, social functions). From its beginnings in 2002 until November 2007, Saath provided credit through individual liability loans. Beginning in November 2007, Saath discontinued individual liability loans, offering instead group liability loans to members applying for loans.

Under the individual liability loan model, a client was required to have been a member of Saath for at least six months with a savings account in order to be eligible for a loan. Members could borrow up to three times their savings account balance, at an interest rate of 18% per year.[4] These individual-liability loans generally require no collateral, however, each loan applicant must meet two requirements. First, the loan applicant must have two "guarantors" who also have a savings account with Saath. Second, the combined savings balances of the loan applicant and the two guarantors must be greater than or equal to the loan amount applied for. Although guarantors are in principle required to maintain these savings balances through the duration of the loan, in practice this rule was not strictly enforced. Guarantors are not eligible for a loan until the loan they guaranteed has been fully repaid, but loan repayment is the sole responsibility of the borrower. Borrowers are required to make monthly installments which cover principal and interest. The monthly principal installment is a fixed amount, and since the interest rate is declining balance, the total installment

[4]Microfinance organizations typically quote interest rates in one of two forms: "declining," the standard used in developed markets, where the amount of interest due each period is calculated based on the interest rate and the remaining principle, and "flat," where the interest payments are calculated using the original principal amount. Thus a 10% "flat" rate is significantly higher than a 10% "declining" rate. Saath quotes rates using the standard declining balance approach.

amount (principal plus interest) varies every month. If the borrower defaults, Saath reserves the right to take the guarantors' savings.

With the group liability model, on the other hand, Saath extends credit to groups of individuals at an interest rate of 24% per year. These groups form primarily through self-selection with joint applications submitted to Saath. Groups are composed of three to six individuals, all of whom must be Saath Microfinance members. Within each group, several criteria must be fulfilled. First, at least 50% of the group must have been Saath Microfinance members for at least 6 months with at least a savings account. Second, at least 50% of the group must be female. Third, relatives or individuals from the same household are not allowed in the same group. And finally, loan terms must be homogenous across group members; that is, the number of installments as well as the monthly installment due dates must be the same, and the loan amount must not vary widely within each group. As in the individual liability model, group liability borrowers are required to make monthly installments for both principal and interest, although in this setting, total installment amounts (principal plus interest) are equated every month. That is, unlike the individual liability model where the monthly principal installment is the same every month, it is the total installment amount that is made to be equal in the group liability setting. Before any loans are disbursed, group members are also required to sign a "mutual agreement form," stating that they are liable to pay each other's debt in the event of default or delinquency. Borrower groups who have defaulted or are delinquent are no longer eligible to receive a next loan from Saath.

3.3 Shift from Individual to Group Liability

Saath's decision to shift from offering individual-liability to group liability loans in November 2007 was due to a change in the management's priorities. Saath wanted to lend to more people, provide larger loan amounts, and expand its microfinance operations geographically, but its lending activities had become stagnant under the individual liability model. In particular, the "guarantors" requirement for individual liability loans restricted credit eligibility, as Saath had already reached a point where almost all of its members were either a borrower or a guarantor. Additionally, savings clients were reluctant to stand as guarantors for another client's loans, and loan amounts were limited to 3 times the total savings account balance of the borrower. Saath management thus shifted to group liability loans to overcome the restrictions in its individual liability model.

In terms of the models discussed above, the limited ability of Saath members to pledge savings as a collateral prevented Saath from expanding, and it saw group liability as a way to solve this problem. In the year following this change, Saath gained almost 800 new clients and increased its reach from 11 to 20 wards.

The transition from individual liability to group liability loans was implemented with the following rule. Beginning in November 2007, all new loans disbursed were group liability loans; Saath would no longer disburse individual liability loans. However, existing loans whose term lasted beyond November 2007 were unaffacted. For example, individual liability loan clients who completed their loan in February 2008 continued under the individual liability contract until then, and following February 2008 would receive a group liability loan should they borrow again. The date of switching from individual to group liability was therefore determined by individual liability loan completion dates. These completion dates and subsequent conversion to group liability loans were distributed relatively uniformly throughout the year.

Although Saath's loan product moved from individual to group liability beginning in late 2007, repayment collection protocol (e.g. place of repayment, frequency of collection) and salaries for field officers remained similar across time in our dataset. An empirical concern for the analysis to follow is whether Saath's policy shift from individual to joint liability was also accompanied by a shift in their loan collection techniques. A survey of field officers conducted in June 2010 confirms that in both individual and group liability settings, field officers collected loan installments at the client's household or workplace every month. For group liability borrowers, Saath does not require groups to designate one of its members as a "group leader," but in practice, almost all groups have a leader who is in charge of collecting repayments from other members. Hence, among individual borrowers, field officers visited each borrower, while among group borrowers, field officers typically visit only the group leader's household. If any member of a particular borrower group fails to make a scheduled payment, the field officer assembles all group members together, and collects the installment amount from the other members as stipulated in the group liability contract. Both individual liability borrowers and joint liability borrower groups in default are not granted any loans in the future. In addition, over the period we study, there was no change in wages among field officers, who continued to receive a fixed monthly sum.[5]

[5]After March 2009 field officers received 1% of the loan interest they collect. Surveys of field officers indicate that

Overall, there are only two differences between Saath's individual and group liability loans: first, the interest rate, which increased from 18% to 24% (declining balance) per year; and second, the required total monthly installment amounts (principal plus interest), which varied slightly month to month in the individual liability model but was constant in the group liability setting. In our main analysis on loan repayment and savings discipline, we will focus only on individuals who converted to group liability loans, exploiting the timing of their switch. By doing so, our empirical design accounts for any self-screening based on the increase in interest rates between the two loan contracts.

4 Data Collection and Summary Statistics

In this study, we use data from Saath Microfinance's administrative software systems. The loan data cover outstanding loans every month from April 2005 through March 2009. Since the change in the type of loan contract occurred in November 2007, the data contain over two years of monthly data on individual liability loans and over one year on group liability loans. Data are available electronically from only 2 out of 4 Saath Microfinance branches, Behrampura and Vasna, and we focus on these. They are the two largest branches, and the oldest, accounting for the vast majority of Saath's clients.

The data were maintained for accounting purposes, recording cash flowing in and out of each branch. They are therefore of very high quality. They do not, however, contain information on the terms of each loan, such as maturity dates, installment amounts, and amounts outstanding. These data were recorded by loan officers in client passbooks and administrative ledgers. As a result, we are unable to look at overdue amounts, prepayments, and other similar measures.[6]

While the data on loans cover April 2005 to March 2009, the savings data were only avail-

they were not aware of this change in compensation structure before it occured. Nevertheless, to isolate the focus of our study on contract structure, we exclude months after March 2009 in the analysis.

[6]The loan data come from three software systems which Saath Microfinance has used at different points in time. Each of the two branches in our dataset used a separate system until early 2008, when the current system was introduced in both branches. Because client identifiers were not carried over from one software system to another, we had to rely on using client names to track individuals over time. These names were unique since they included first, middle, and last names. In identifying clients across systems, 80% of the clients had exact name matches, while 14% had to be matched by hand due to name spelling errors. The remaining 6%, on the other hand, could not be matched to the current software system. It is likely that these clients have withdrawn their membership with Saath Microfinance and therefore have not borrowed under the group liability setting, since Saath migrated information from the previous to the current software system only for existing members.

able from January 2008 to March 2009. The savings data include monthly aggregate deposit and withdrawal amounts, for compulsory savings accounts.

As previously described, in our main analysis we study borrowers who have received both individual and group liability loans to overcome the selection problem. Hence, in our dataset, these clients begin with an individual liability loan, and after November 2007, receive a group liability loan. Within Saath's Behrampura and Vasna locations, we find a sample of 276 such clients, representing 22% of the loan client base in these two branches as of March 2009.

Table 1 provides summary statistics for our sample. Collectively, these clients received a total of 748 loans from Saath, 450 of which are individual liability loans and 298 are group liability loans. The average individual liability loan amount is about INR 10,000 (USD 220), and about INR 18,000 (USD 390) for group liability loans. Figure 1 plots the number of group liability loans that are disbursed over time. As the figure shows, the borrowers in our sample, all of whom received individual liability loans, switched to group liability loans at varying months. Our empirical strategy takes advantage of this staggered timing, comparing individual liability loan clients who have already received group liability loans to future recipients, to identify the impact of group liability on loan repayment behavior and savings discipline.

5 Empirical Strategy and Analysis

5.1 Empirical Strategy

Our first empirical tests measure the extent of assortive matching, using two complementary sets of analysis. First, we use a simple regression framework. For each individual i who belongs to a joint liability borrower group, we define a measure of 'reliability,' r_i, (discussed in greater detail below), as well as the average reliability of that individual's group members (i.e., $y_i = \frac{1}{N_{G_i}} \sum_{j \in G_i, j \neq i} r_j$, where N_{G_i} is the number of borrowers in the group G_i of which i is a member). We thus regress:

$$y_i = \alpha + \beta r_i + \varepsilon_i \tag{1}$$

clustering standard errors at the borrower-group level.

Our second measure is based on a permutation test. We first randomly assign members into

groups, keeping the original distribution of group sizes.[7]. We estimate the coefficient β from Equation (1) on this set of randomly assigned individuals. We repeat this exercise 10,000 times and plot the distribution of coefficients. We then compare the actual coefficient to the distribution generated at random.

To study the effect of contract structure on lending outcomes, we exploit the natural experiment provided by Saath's change in policy. The presence of an exogenous policy change is important. Without exogenous variation, it would be very difficult to know whether differences in outcomes were attributable to contract structure, or any number of other unobservable characteristics of borrowers or lending institutions. Indeed, theory predicts that different contracts will be optimal for different types of borrowers.

To overcome this selection problem, we focus our attention to borrowers of Saath who received both individual and group liability loans. We exploit the natural phasing-in of group liability, in what amounts to a repeated difference-in-difference framework. At any particular point in time, our "treatment" group then consists of clients who have fully repaid their individual liability loan and currently have a group liability loan, while our "control" group consists of individual liability loan clients who will eventually convert to a group liability loan. Specifically, we estimate the following equation:

$$y_{ilt} = \alpha + \beta T_{il} + \gamma_i + \delta_t + \epsilon_{ilt} \tag{2}$$

where the subscript i refers to individuals, l refers to loans, and t refers to months. T is a dummy variable equal to 1 if loan l of client i is a group liability loan, and 0 if it is an individual liability loan. y_{ilt} is a measure of loan repayment or savings discipline. The estimate of β then provides the effect of switching to group liability loans for individuals who are already borrowing. We include time effects δ_t since conversion to group liability loans was staggered across individuals, and the individual fixed effects γ_i absorb time-invariant characteristics of each borrower.

5.2 Self-screening and Assortative Matching

Section 2 discusses the theoretical underpinnings of how self-selected groups may be formed under a joint liability setting. The theory predicts self-sorting and matching of the same types of individuals;

[7] In the data, we observe 12 groups of size 3, 123 groups of size 4, 37 groups of size 5, and 6 groups of size 6.

specifically, Ghatak (2000) predicts assortative matching where safe borrowers form groups with other safe borrowers.

Following the change in contract structure, individuals were obliged to form groups, but were free to choose their own group members. Table 2 presents evidence on assortative matching among Saath microfinance clients, using a variety of measures of borrower quality. Since many group loan members in this analysis are first-time borrowers who never previously held an individual liability loan, we cannot use past loan repayment or default data as a measure of borrower quality. However, we do observe compulsory savings data for everyone since, as per Saath regulation, every applicant must have a compulsory savings account with Saath for at least six month prior to applying for a loan. For this reason, our borrower quality measures are based on savings rather than loan data.

In columns (1) to (3) of Table 2, the 'reliability' of a borrower is defined as the proportion of compulsory savings deposits that were missed before the group liability loan; columns (4) to (6) define 'reliability' as a dummy variable equal to 1 if any past compulsory savings deposit was missed. Under both these definitions of reliability, we find strong evidence of assortative matching, that is, we find that the average reliability of group members is strongly and positively associated with the borrower's own level of reliability. This result is robust across specifications, and holds even when we include neighborhood fixed effects.[8]

As a further test of assortative matching, Figure 2 plots the distribution of the regression coefficient on own reliability level from 10,000 randomly formed group combinations. The idea behind this exercise is to simulate the reliability profile of groups if they were truly randomly formed with no endogenous matching. The red dot represents the regression coefficient that we observe in our data. As is clearly evident, our observed coefficient is on the extreme right tail of all the distributions we plot, confirming that borrower self-screening is at play in group formation, even controlling for physical proximity.

While the analysis above suggests a strong self-screening mechanism within joint liability groups, we cannot distinguish how much more informative this screening is than what Saath could have achieved through its own devices. We do, however, note that everyone in our sample had already been approved by Saath for a loan; the strong evidence of sorting even within this group suggests

[8] As a third definition of 'reliability', we consider a dummy for whether the client missed the compulsory savings deposit in the month prior to receiving a group liability loan, and obtain similar results.

borrowers may have substantial inside information about each other's quality.

5.3 Loan Repayment

We now turn to the critical question of loan repayment. We note that the joint liability structure will in theory induce both better screening (demonstrated above), but also greater monitoring efforts. Our empirical design does not distinguish between the two potential causes of improved repayment, but rather estimates the combined causal effect.

Table 3 presents OLS estimates of Equation 2, where the outcome of interest is a dummy variable for a missed payment. This dummy variable indicates whether the client failed to make a repayment for a particular month. Saath Microfinance clients are required to make monthly repayments until the principal balance is paid in full, beginning 30 days following disbursement. Hence, the dependent variable takes on the value 1 for a particular month if the total amount repaid by the borrower for that month is nil, and 0 otherwise. We use this dummy variable as our first measure of monthly loan repayment discipline.

In our sample, almost 20% of individual liablity and only 0.1% of group-liabilty monthly loan repayments were not made. Our results in Table 3 indicate that under the group liability contract, monthly loan repayments are about 6% less likely to be missed relative to individual liability, significant at the 5% level. Controlling for other factors such as time trends and individual characteristics does not affect these results.

As a further robustness check, we conduct a direct "falsification" test of our analysis by using data from our clients' previous individual-to-individual loan renewals. The sample is reduced since many clients did not have multiple individual loans in the past. Table 4 presents these results and shows no significant effect on missed payments.

Another concern over our empirical strategy is in the sample selection; since our sample consists of individual liability clients who chose to renew their borrowing under the group liability setting, these clients may be better at repayment than borrowers who did not want to enter into a group liability loan contract. However, our analysis focuses exclusively on those who renew, and includes individual fixed effects. Hence, an interpretation of our results is that even "good" clients exhibited higher repayment discipline under the group liability setting, in comparison to the individual liability setting.

Yet another concern is that a client's propensity to repay may be correlated with the time in the loan cycle. Specifically, clients may be more likely to make repayments towards the end of the cycle on their individual liability loan, so that they may become eligible for a group liability loan in the future. We note that this would bias estimates against finding that group liability improves borrower performance. Nevertheless, we investigate this possibility using an event-time regression with the dependent variable for missed payment as previously described, where the event is the conversion from an individual liability to a group liability-loan.

Figure 3 plots the coefficients for each event-time dummy. The first month of repayment in the group liability setting is at $time = 0$, the final repayment month in the individual liability loan is at $time = -1$, the second to the last individual liability loan repayment month is at $time = -2$, and so on. Thus, the figure describes loan repayment behavior under the individual liability contract, before switching to group liability. Saath requires its borrowers to pay their current loan in full before they are given a next loan, so by definition, all clients in our sample made a repayment at $time = -1$. Examining the periods where $time \leq -2$ shows no pattern supporting the idea that clients strategically repaid their individual liability loan so that they may borrow under the group liability setting.

On the other hand, it might also be the case that clients are more likely to make repayments early on than towards the end of the loan cycle. For example, clients may have more liquidity to repay immediately following loan disbursal, but become less able (or willing) to pay as the loan matures. We examine this possibility, again using an event-time regression, as shown in Figure 4. We estimate how repayment rates change around loan renewal times when an client pays off an individual liability loan and renews for another individual liability loan (blue line), and for the cases when a client pays off a group liability loan and renews for a second group liability loan (red line). Note that the first month of repayment in the second loan cycle is at $time = 0$, and the final repayment in the first loan cycle is at $time = -1$. Similar to Figure 3, at $time = -1$, all clients made a repayment by definition, so the missed payment dummy must mechanically equal zero. To control for any possible effects of maturity on repayment, we include 'loan age in months' (i.e., the number of months which have passed since the loan was disbursed), as an explanatory variable in Columns (3) and (4) of Table 3. The point estimate on the group liability loan dummy remains statistically significant. Figure 5 further shows that prior missed payments are uncorrelated with

the calendar month of loan origination.

Finally, the outcome we have considered thus far, whether the client missed a loan installment for a particular month, is a rough measure since repayments may be partial. That is, a client may have repaid an amount greater than zero, but this amount may be less than the required installment amount. Another measure of repayment discipline then is the standard deviation of principal amount repaid for individual liability loans, and total amount repaid for group liability loans. As described in Section 3, the principal installment amount was fixed in the individual liability setting, whereas in group liability, the required total installment amount (principal plus interest) was equated every month. If the required amount is repaid each month, then the standard deviation would be zero. However, if there are many months where people pay less or more than the required amount, then the standard deviation would be higher. Table 5 provides OLS estimates where the dependent variable is the standard deviation of repayment. Again, our estimates show that there is greater loan repayment discipline in the group liability setting, relative to individual liability.

Given these results, a natural question that arises is why group liability outperforms individual liability for clients who are already borrowing. Although the guarantors requirement in individual liability contracts provided incentives for guarantors to monitor loans and enforce repayment, these incentives in practice were quite weak: the microlender rarely seized the savings of guarantors of defaulting clients, and did not strictly enforce that guarantors maintain their savings account balance. The microlender collected repayment from the guarantors only if all other options (e.g. seizing the defaulting borrower's savings, revisiting the defaulting borrower, threatening to charge penalties, rescheduling the loan, having the branch manager intervene) have been exhausted. In contrast, the group liability structure strengthens cooperation and trust among group members, as indicated by the fact that almost all joint liability borrower groups designate a group leader even though it is not required. It is possible that having a group leader increases incentives for monitoring and enforcing repayment. For example, having a group leader perhaps creates a person of authority who can enforce repayment or impose sanctions in the event of default.

5.4 Savings Discipline

We now turn our attention to the compulsory savings deposits required by Saath. We might expect that savings discipline is higher in the group liability setting, since compulsory savings may act as a form of insurance when a group member defaults.

Although Saath initiated both a shift to group liability lending and compulsory deposits at the same time in November 2007, we can uniquely identify the effect of group liability on compulsory savings by exploiting the time-series variation in loan renewals. Specifically, while the compulsory savings were mandated across the board for all borrowers post-November 2007, the shift from individual to group liability was more staggered, depending on when each individual loan term expired. As explained earlier, these renewals were distrubted relatively uniformly throughout the year. Hence, we can study the adherence to compulsory savings for the same person who was borrowing under an individual liability contract post November 2007, and who eventually converted to a group liability contract.[9]

Table 6 presents OLS estimates where our dependent variable is a dummy for missing a compulsory savings deposit. The dependent variable takes on the value 1 if the client deposited less then INR 100, and 0 otherwise. Our results indicate that the same borrower exhibits greater savings discipline when in a group liability loan than when in an individual liability loan: compulsory savings depoists are about 19% less likely to be missed in the group liability setting, significant at the 5% level.

6 Conclusion

Microfinance has reached over 150 million borrowers worldwide, and is growing at a 40 percent cumulative average growth rate. Recent initial public offerings (IPOs) which valued the Mexican microfinance institution Compartamos at $2 billion, and SKS in India at $1.5 billion, have attracted the attention of global financial markets. Yet, there have also been spectacular failures, such as the collapse of Banco del Exito (BANEX), which with a $125 million dollar loan portfolio was recently the largest micro and small and medium enterprise lender in Nicaragua. Suffering from a 45 percent

[9]Since we only have savings data from January 2008 onwards, we cannot study the effect of compulsory savings under the individual liability setting as we have no pre-period data (i.e. savings data pre-November 2007).

delinquency rate, it was ordered into liquidation.[10]

As many microlenders around the world weaken their group liability approach and shift towards individual lending, understanding the role of group liability in enhancing performance has become a critical question in microfinance programs, moving forward. Yet, the empirical literature provides little guidance for policy makers and microfinance practitioners, since few empirical studies have examined group liability contracts with other lending strategies.

In this paper, we exploit an exogenous change in liability structure in an Indian microfinance program, where the program shifted from individual liability to a group liability structure. We find evidence that for the same borrower, the shift to group liability reduces default rates and improves savings discipline. Under the group liability setting, required monthly loan installments are 6% less likely to be missed and compulsory savings deposits are about 19% less likely to be missed, relative to individual liability. Thus, our findings indicate that group lending outperforms individual lending in loan repayment and savings discipline.

The microlender we study, Saath, has operations that are fairly typical of MFIs that lend in urban areas. Overall, our results suggest that group liability in microfinance may be a particularly effective contract in improving repayment behavior, especially for clients who are already borrowing. A promising avenue for further research is to study the precise mechanisms for this improved behavior, that is, the relative merits of peer screening versus peer monitoring under group liability contracts. Further, if peers are indeed effective screeners or monitors, an open research question is whether group liability contracts can be made even better, perhaps by introducing some formal group or sub-group level repayment incentives or insurance mechanisms.

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[10] See: http://financialaccess.org/node/3547

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Table 1: Summary Statistics

This table reports summary statistics for borrowers in our sample. These borrowers received both individual liability and group liability loans.

Branch	Total No. of Clients	Total No. of Loans	Individual Liability		Group Liability	
			No. of Loans	Ave. Loan Amt (Rs.)	No. of Loans	Ave. Loan Amt (Rs.)
Behrampura	198	512	303	9959.646	209	19081.34
Vasna	78	236	147	9927.211	89	16764.04
Full Sample	276	748	450	9948.761	298	18389.26

Table 2: Tests for Assortative Matching: Do Individuals Join Groups of Similar Reliability?

This table reports OLS regressions with cross-sectional data at the individual level, where the dependent variable is the average reliability of other group members. That is, for each individual who belongs to a particular borrower group, the dependent variable is the average reliability of the rest of the group members, not including the individual. In columns (1) to (3), reliability is defined as the proportion of compulsory savings deposits that were not made between January 2008 and the month before the group liability loan was disbursed. In columns (4) to (6), reliability is defined as a dummy for missing any complusory savings deposit between January 2008 and the month before the group liability loan was disbursed. The variables `Own Reliability Level` and `Reliability Dummy` thus refer to each individual's own measure of reliability, given these definitions. Group liability loan borrowers who received their loan on or before January 2008 are excluded in these regressions. `Behrampura` is a dummy for one of the two MFI branches in the sample. `Entire group is female` is a dummy variable equal to 1 if all members of the borrower group are female, 0 otherwise. `Entire group lives in same neighborhood` is a dummy variable equal to 1 if all members of the borrower group live in the same neighborhood, 0 otherwise. In columns (1) and (4), the sample includes all group liability loan clients. In columns (2)-(3) and (5)-(6), the sample consists of group liability loan clients who belong to a borrower group where all group members live in the same neighborhood, focusing on neighborhood where there is more than one such group. Robust SEs, clustered at the borrower group level.

	(1)	(2)	(3)	(4)	(5)	(6)
Own Reliability Level	0.414***	0.409***	0.287***			
	(0.046)	(0.064)	(0.058)			
Reliability Dummy				0.340***	0.355***	0.274***
				(0.043)	(0.060)	(0.058)
Behrampura	-0.148***	-0.195***		-0.204***	-0.240***	
	(0.027)	(0.043)		(0.042)	(0.065)	
Entire group is female	-0.012	-0.036	-0.026	-0.013	-0.047	-0.001
	(0.021)	(0.026)	(0.036)	(0.040)	(0.053)	(0.078)
Entire group lives in same neighborhood	-0.041*			-0.029		
	(0.021)			(0.032)		
Constant	0.326***	0.340***	0.153***	0.601***	0.615***	0.378***
	(0.039)	(0.058)	(0.041)	(0.063)	(0.105)	(0.095)
Neighborhood FEs	No	No	Yes	No	No	Yes
R-squared	0.435	0.480	0.570	0.325	0.346	0.427
N	833	471	471	833	471	471
Mean of Dep Var	0.315	0.281	0.281	0.646	0.620	0.620

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Dependent Variable: Missed Payment Dummy

This table reports results from OLS regressions with panel data from April 2005 to March 2009, where the dependent variable is a dummy for missing a payment. This dummy takes on the value of 1 for a particular month if the total amount repaid by the borrower for that month is nil, and 0 otherwise. Observations are at the loan-month level. The variable `Group Liability Loan Dummy` is a dummy variable equal to 1 if the loan is a group liability loan, 0 if it is an individual liability loan. `Loan Amount` refers to the amount the client received for that particular loan. `Behrampura` is a dummy for one of the MFI branches in the sample. `Number of Previous loans` is the number of loans that the client received before the current loan. `Loan Age in Months` is the difference between the month of the observation and the month when the loan was disbursed, plus 1. The sample includes loans of clients who received both an individual and a group liability loan. Robust standard errors, clustered at the individual level, are given in parentheses beneath each point estimate.

	(1)	(2)	(3)	(4)
Group Liability Loan Dummy	-0.169***	-0.160***	-0.148***	-0.064**
	(0.014)	(0.014)	(0.014)	(0.031)
Loan Amount		-0.000***	-0.000***	-0.000
		(0.000)	(0.000)	(0.000)
Behrampura		0.068***	0.068***	
		(0.015)	(0.016)	
Number of Previous Loans			-0.003	0.055***
			(0.007)	(0.020)
Loan Age in Months			0.007***	0.007***
			(0.002)	(0.002)
Constant	0.170***	0.151***	0.118***	0.281***
	(0.013)	(0.016)	(0.017)	(0.087)
Control for Calendar Month	No	No	No	Yes
Individual FEs	No	No	No	Yes
R-squared	0.072	0.086	0.094	0.251
N	6055	6055	6055	6055
Mean of Dep Var	0.105	0.105	0.105	0.105

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Falsification Test

This table reports results from a falsification test, where the dependent variable is a dummy for missed payment. This dummy variable takes on the value of 1 for a particular month if the total amount repaid by the borrower for that month is nil, and 0 otherwise. The regressions correspond with those in Table 3. `False Treatment` is a dummy variable equal to 1 if the loan was disbursed after November 2006, 0 otherwise. Observations are at the loan-month level. `Loan Amount` refers to the amount the client received for that particular loan. `Behrampura` is a dummy for one of the MFI branches in the sample. `Number of Previous loans` is the number of loans that the client received before the current loan. `Loan Age in Months` is the difference between the month of the observation and the month when the loan was disbursed, plus 1. The sample contains observations of individual liability loans among clients who received both individual and a group liability loan, and who obtained at least 2 individual liability loans, the most recent of which was disbursed after November 2006. Robust standard errors, clustered at the individual level, are given in parentheses beneath each point estimate.

	(1)	(2)	(3)	(4)
False Treatment	0.002	-0.003	0.018	0.049
	(0.025)	(0.023)	(0.025)	(0.049)
Loan Amount		-0.000	-0.000	0.000
		(0.000)	(0.000)	(0.000)
Behrampura		0.074***	0.065**	
		(0.027)	(0.029)	
Number of Previous Loans			-0.025	0.030
			(0.015)	(0.041)
Loan Age in Months			-0.001	0.004
			(0.003)	(0.004)
Constant	0.139***	0.112***	0.129***	0.269**
	(0.020)	(0.025)	(0.032)	(0.112)
Control for Calendar Month	No	No	No	Yes
Individual FEs	No	No	No	Yes
R-squared	0.000	0.013	0.016	0.174
N	1584	1584	1584	1584
Mean of Dep Var	0.140	0.140	0.140	0.140

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Dependent Variable: Standard Deviation of Repayment

This table reports results from OLS regressions with cross-sectional data, where the dependent variable is the standard deviation of monthly repayment: if the required amount is repaid every month, then the standard deviation would be zero; if there are many months where people pay less or more than the required amount, then the standard deviation would be higher. Observations are at the loan level. The variable `Group Liability Loan Dummy` is a dummy variable equal to 1 if the loan is a group liability loan, 0 if it is an individual liability loan. `Loan Amount` refers to the amount the client received for that particular loan. `Behrampura` is a dummy for one of the MFI branches in the sample. The sample includes loans of clients who received both an individual and a group liability loan. Robust standard errors, clustered at the individual level, are given in parentheses beneath each point estimate.

	(1)	(2)	(3)
Group Liability Loan Dummy	-288.666	-1002.052***	-813.105***
	(185.204)	(186.520)	(280.590)
Loan Amount		0.085***	0.069***
		(0.011)	(0.020)
Behrampura		732.502***	
		(121.145)	
Constant	1352.427***	14.284	-477.704**
	(100.308)	(148.592)	(241.601)
Individual FEs	No	No	Yes
R-squared	0.005	0.176	0.503
N	689	689	689
Mean of Dep Var	1243.496	1243.496	1243.496

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Dependent Variable: Missed Compulsory Deposit

This table reports results from OLS regressions with panel data from January 2008 to March 2009, where the dependent variable is a dummy for missing a compulsory deposit. This dummy takes on the value of 1 for a particular month if the client deposited less than the required amount of Rs. 100, and 0 otherwise. Observations are at the individual-month level. The variable `Group Liability Loan Dummy` is a dummy variable equal to 1 if the client had a group liability loan, 0 if it is an individual liability loan. `Loan Amount` refers to the amount the client received for that particular loan. `Behrampura` is a dummy for one of the MFI branches in the sample. `Number of Previous loans` is the number of loans that the client received before the current loan. `Loan Age in Months` is the difference between the month of the observation and the month when the loan was disbursed, plus 1. The sample includes clients who received both an individual and a group liability loan. Robust standard errors, clustered at the individual level, are given in parentheses beneath each point estimate.

	(1)	(2)	(3)	(4)
Group Liability Loan Dummy	-0.234***	-0.238***	-0.238***	-0.187**
	(0.035)	(0.037)	(0.038)	(0.084)
Loan Amount		0.000	0.000	0.000
		(0.000)	(0.000)	(0.000)
Behrampura		0.001	0.000	
		(0.036)	(0.036)	
Number of Previous Loans			-0.002	0.093
			(0.018)	(0.131)
Loan Age in Months			0.000	0.016*
			(0.003)	(0.010)
Constant	0.391***	0.381***	0.382***	0.657***
	(0.031)	(0.044)	(0.046)	(0.125)
Control for Calendar Month	No	No	No	Yes
Individual FEs	No	No	No	Yes
R-squared	0.054	0.055	0.055	0.513
N	2929	2929	2929	2929
Mean of Dep Var	0.205	0.205	0.205	0.205

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 1: Group Liability Loans Disbursement in Sample

This figure plots the number of group liability loans that are disbursed over time in our sample. All borrowers are previously individual liability borrowers, who subsequently received a group liability loan after the policy change.

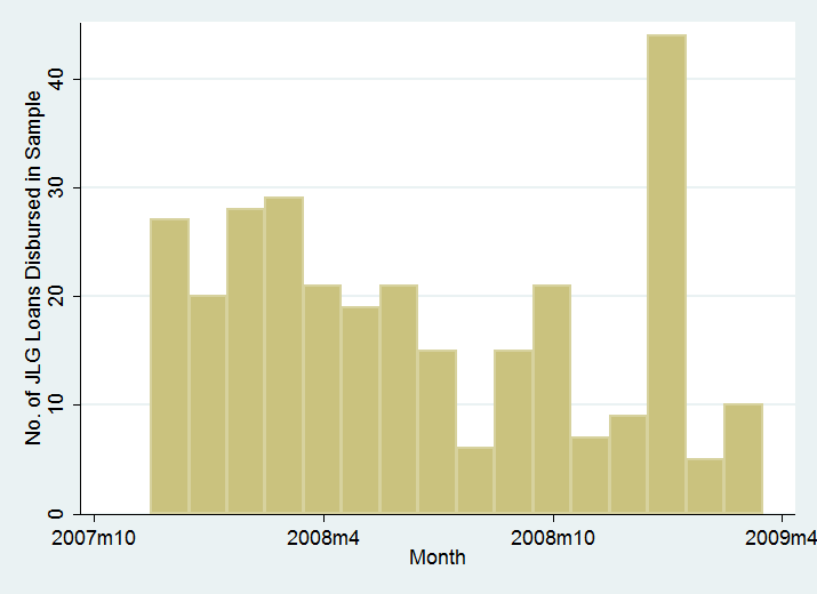
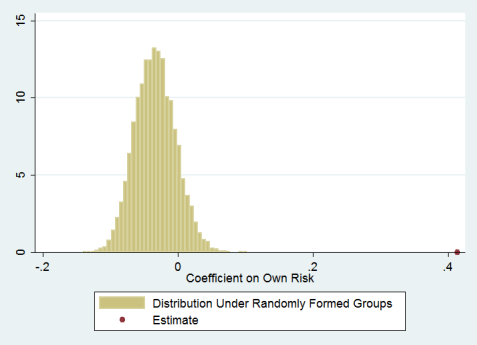
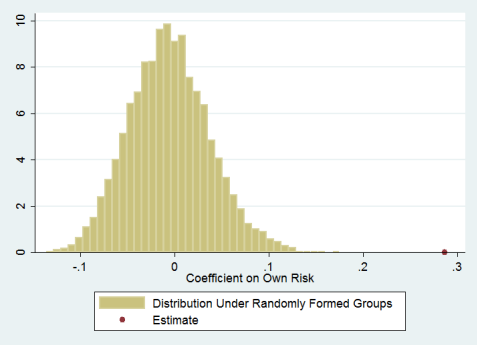


Figure 2: Group Formation under Joint Liability

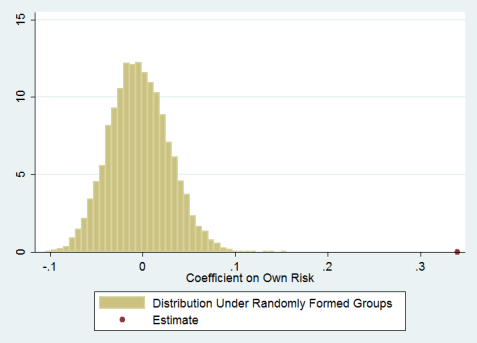
These figures plot the distribution of the coefficient on the client's own reliability level, from the regressions in Columns (1), (3), (4) and (6) of Table 2, if borrower groups are randomly formed. The distribution comes from 10,000 iterations. The red dot represents the point estimate observed. Figures in the left column are from regressions which include all group liability loan clients. Figures in the right column are from regressions which include group liability loan clients who belong to a borrower group where all group members live in the same neighborhood, focusing on neighborhoods where there is more than one such group. These figures represent different definitions of reliability, as indicated below.



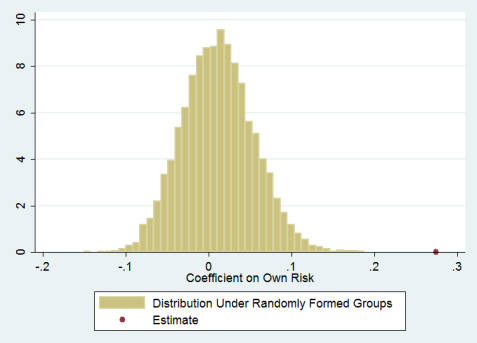
(a) Reliability Defined as Proportion of Compulsory Savings Missed Before JLG Loan Starts (All Groups)



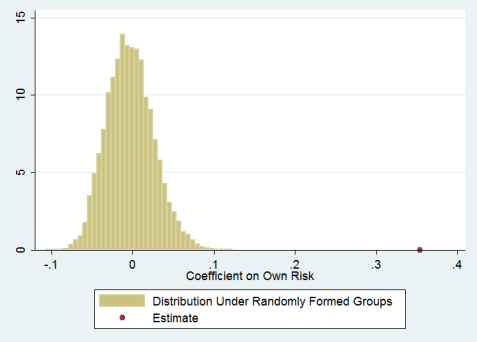
(b) Reliability Defined as Proportion of Compulsory Savings Missed Before JLG Loan Starts (Within Neighborhood)



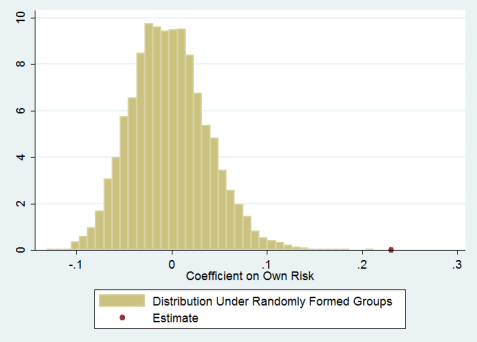
(c) Reliability Defined as Whether You Missed Any Compulsory Deposit Before JLG Loan Starts (All Groups)



(d) Reliability Defined as Whether You Missed Any Compulsory Deposit Before JLG Loan Starts (Within Neighborhood)



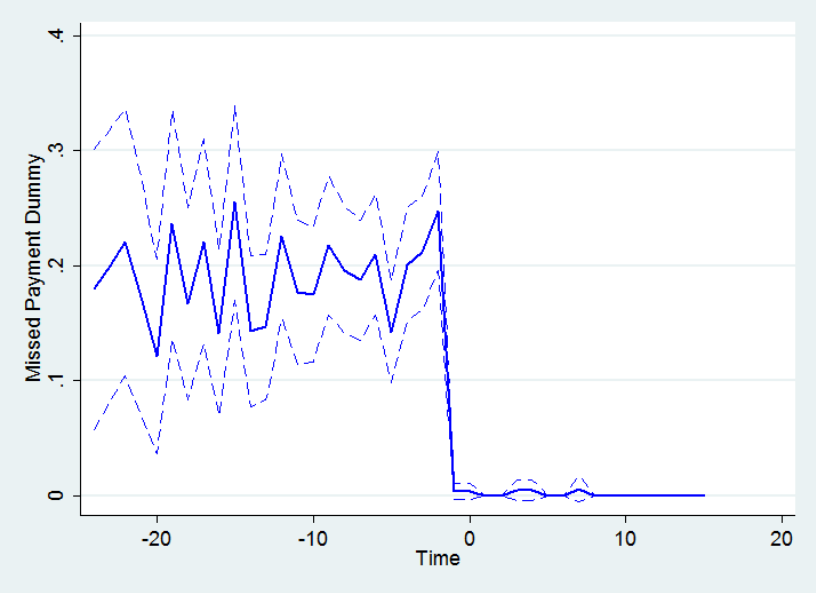
(e) Reliability Defined As Whether You Missed The Compulsory Deposit In The Month Before JLG Loan Starts (All Groups)



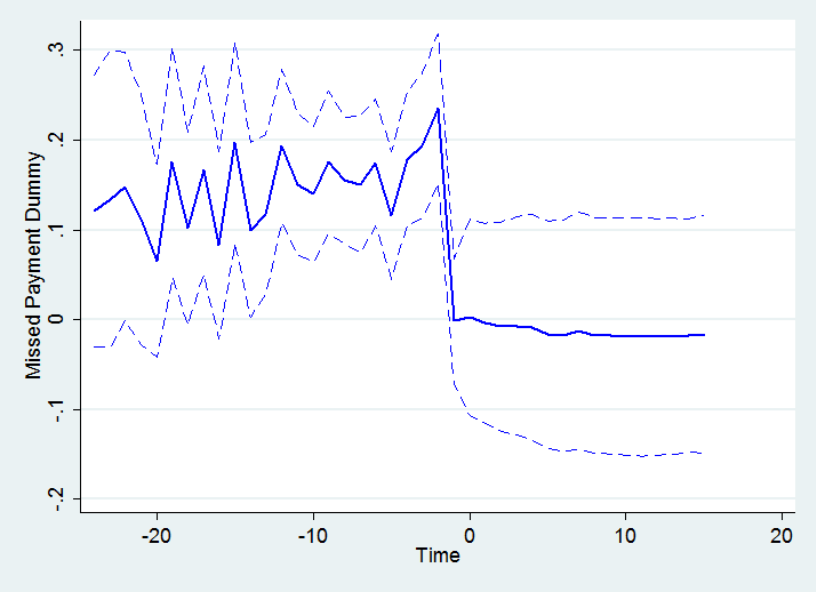
(f) Reliability Defined As Whether You Missed The Compulsory Deposit In The Month Before JLG Loan Starts (Within Neighborhood)

Figure 3: Event Time Regression: Missed Payment on Event Time Dummies of Switching from Individual to Group Liability Loan

This figure plots coefficients for event-time dummies where the event is the conversion from individual liability to a group liability loan. The dependent variable is a dummy for missing a monthly repayment, which takes on the value 1 for a particular month if the total amount repaid by the borrower for that month is nil, and 0 otherwise. The first month of repayment in the group liability setting is at $time = 0$, the final repayment month in the individual liability setting is at $time = -1$. The dashed lines indicate the 95% confidence interval.



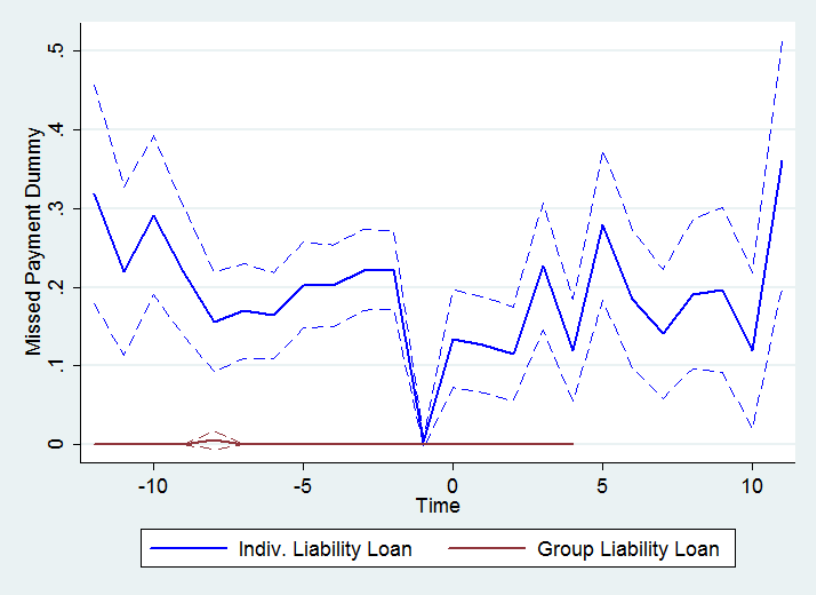
(a) No Controls



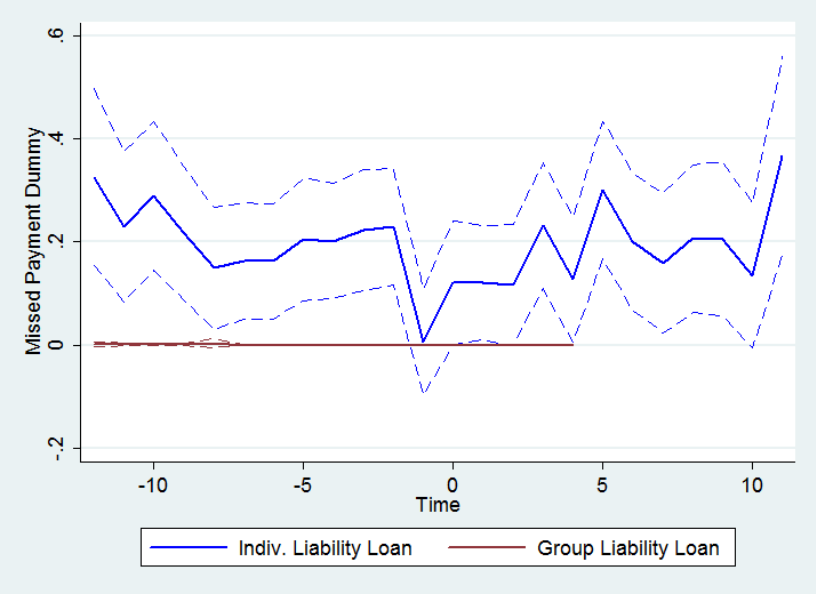
(b) With Month FEs

Figure 4: Event Time Regression: Missed Payment on Event Time Dummies of Switching from the First to the Second Loan Cycle

This figure plots coefficients for event-time dummies where the event is the shift from the client's first loan cycle to the second loan cycle, for each of the individual and group liability loans. The dependent variable is a dummy for missing a monthly repayment, which takes on the value 1 for a particular month if the total amount repaid by the borrower for that month is nil, and 0 otherwise. The first month of repayment in the second loan cycle is at $time = 0$, the final repayment month in the first loan cycle is at $time = -1$. The dashed lines indicate the 95% confidence interval.



(a) No Controls



(b) With Month FEs

Figure 5: Calendar Month of Loan Origination and Missed Payments

This figure plots the percentage of monthly repayments that were missed, using the first three repayments from loan disbursement of the client's most recent individual liability loan. The calendar month of loan origination refers to the calendar month when the loan was disbursed. The size of the bubbles represent frequencies. The red line represents the best-fit line. The sample includes clients who received both an individual and a group liability loan.